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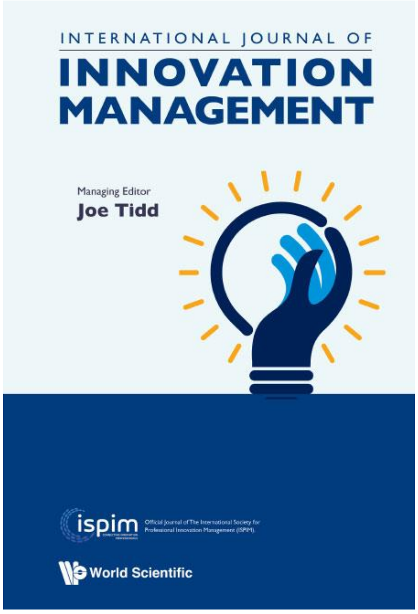

A REVIEW AND CRITICAL ASSESSMENT OF THE ISO56002 INNOVATION MANAGEMENT SYSTEMS STANDARD: EVIDENCE AND LIMITATIONS

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The ISO56002 international standard for managing innovation systems was published in 2019. In this paper we review the rationale, the key features, and the evidence base for this new standard. The primary objective of the standard is to promote the professionalization of the field by providing a framework for management and organizational practice. The standard was developed by a wide range of stakeholders, including consultants and professional associations, and therefore features most elements we would expect from such a high-level, generic approach: strategy, organization, leadership, planning, support, process, performance evaluation, improvement. We examine the empirical base for each of these components in this paper. We also identify some critical shortcomings, such as the implicit adoption of a linear model, lack of specific tools to support practice, or any significant variation in application by sector or context. Finally, we recommend how the standard could be improved and implemented in practice.

Key words: standards, ISO56002, strategy, organization, leadership, planning, support, process, performance evaluation, improvement

Rationale for a standard system

The ISO56002 international standard for managing innovation systems was published in 2019. One of the primary objectives of the new standard is to promote the professionalization of the field by providing a framework for management and organizational practice, following the approach of earlier standards for quality management and project management. The innovation standard was developed with the inputs from a wide range of stakeholders, including consultants and professional associations, and therefore features most elements we would expect from such a high-level, generic approach: strategy, organization, leadership, planning, support, process, performance evaluation, improvement (Table 1).

The body of knowledge available to inform the development of a standard for innovation management is substantial, as the systematic study of the field began in the 1970s, so we now have fifty years of accumulated knowledge and experience to draw upon. Therefore, it is important to selectively draw from this deep well, rather than simply to skim the surface by institutionalising contemporary theories and practices promulgated by various business school publishers and consultants. We must also guard against the common bias in innovation research and practice for recency, rather than relevance and rigour. Much of the fundamental interdisciplinary research on technology and innovation management was conducted in the 1970-1990s, but the subsequent studies by management disciplines and business school functional groups has largely ignored this knowledge base and instead fragmented the field to the detriment of research and practice.

Innovation first became an explicit element of managerial practice in the late 19th century with the emergence and rapid growth of large chemical and electrical firms in the USA and Germany (Pavitt, 1990). Today innovation is a key requirement of almost all organizations, but in many more diverse settings. Two related streams of research and practice have influenced the development of the field of innovation management. The first has its origins in the field of operations management, which focuses on the management of increasingly complex manufacturing and process technologies. Important developments in this body of knowledge include diffusing 'lean thinking' practices from the automobile industry and using information technology to improve process management. The second stream of research focuses more on new product development, and attempts to understand what makes an innovation a success. Early work consisted largely of anecdotal descriptions of the attributes of successful innovators and case studies of successful innovations. The pioneering SAPPHO project (Scientific Activity Predictor from Patterns with Heuristic Origins) advanced the field by using a comparative methodology to explain differences between successful and unsuccessful innovators in organizational terms (Rothwell *et al*., 1974). It showed that more successful organizations had: better understanding of user needs; more attention to marketing and publicity; more efficient development work; greater use of outside technology and scientific advice (an insight which pre-dates open innovation by many decades); and the involvement of senior individuals as project champions (but not necessarily "leaders" of innovation). Moreover, it showed that these factors worked together rather than in isolation.

Rothwell's (1977) early review of nine previous studies identified similar success factors such as: effective communication and collaboration; seeing innovation as a corporate-wide task; efficient development work; use of management techniques; quality and style of management; attention to marketing and user needs; provision of after sales service and user education; and championing of innovation by key individuals. Cooper's subsequent seminal work (1979, 1994; Cooper and Kleinschmidt, 1995) had a more explicit focus on new product development (NPD) rather than innovation more generally and showed that the three most import success factors are product uniqueness and superiority, market knowledge and marketing proficiency, and technical and production synergy and proficiency. Other important success factors identified in Cooper's studies were: sharp and early product definition; a cross- functional team approach; high-quality execution; and probably his most famous finding, the use a multi-stage innovation process with stage-gates for project evaluation.

Prior to the development of the standard, there have been numerous attempts to integrate the diverse research on and practice of managing innovation, to better define and delineate the field. Some have been motivated to develop a standard training schedule or teaching syllabus for accreditation purposes (Collins *et al*, 1991), others to guide learning and practice (Tidd *et al*, 1997), or to promote interdisciplinary research (Fagerberg *et al*, 2012; Tidd and Nightingale, 2018).

Whilst any standard for managing innovation is likely to be high-level and generic, research and practice have since moved on from simply identifying 'best-practices' and analysing 'success factors', to exploring sectoral diversity, project-based and complex innovations and, most recently, technology-enabled service innovation (Tidd and Hull, 2003; Tidd, 2020). In the next section we explore the evidence-base for each of the key elements of the ISO standard, and identify some of the management and research challenges in adapting and applying this.

Key components of the standard "system"

Table 1. Mapping the ISO56002 Standard for Innovation Management Systems against core topics in the innovation literature

ISO56002 Standard 2019 "Managing Innovation Systems"	**Relevant core innovation topics from the body of knowledge**	**Seminal studies**	**Recent research and reviews**
Leadership and Intent	Individual roles, goals, context	Howell and Avolio (1993); Macdonald and Williams (1994)	Isaksen and Tidd (2006); Hughes *et al* (2018)
Organization	Climate and culture, structure, teams, collaboration	Allen (1977); Burns and Stalker (1966)	Anderson *et al* (2014); Tidd (2021)
Planning and Support	Strategy, resource-based view, core capabilities	Teece *et al* (1997)	Barreto (2010); Teece (2010); Keupp *et al* (2012)
Process:	Stage-gate, development funnel, non-linear models,	Rothwell (1994); Cooper (1994); Wheelwright and Clark (1992)	O'Reilly and Tushman (2013); Tidd and Bessant (2021)
1. Identify opportunities	Sources of innovation, search strategies	Pavitt (1984); von Hippel (1988).	Chesbrough (2003); Leiponen and Helfat (2010)

2. Create concepts	Creativity, fuzzy front end, idea management	Smith and Reinersten (1992); von Hippel (1994)	Gassmann and Schweitzer (2013)
3. Validate concepts	Design-thinking, prototyping, lead users	Kelly (2001)	Ries (2011)
4. Develop solutions	New product and service development	Cooper and Kleinschmidt (1995)	Schweitzer and Tidd (2018)
5. Deploy solutions	Implementation, diffusion of innovation	Rogers (2003)	Perese *et al* (2010); Tidd (2010); Iyengar *et al* (2011)
Performance evaluation	Innovation metrics, success factors	Rothwell *et al* (1974)	Brem *et al* (2019)
Improvement	Capturing learning, dynamic capabilities	Levitt and March (1988); Cohen and Levinthal (1990)	Nonaka and Takeuchi (1995)
Value	Appropriability regime, business model innovation, intellectual property	Teece (2010)	Osterwalder and Pigneur (2010); Spieth *et al* (2013)

Leadership and Intent

Effective leadership of innovation does not consist of a shopping-list of "ideal" traits or skills. Instead it is highly-sensitive to the nature of the challenge, for example radical versus incremental innovation, and the characteristics of those innovating, the so-called leader-member exchange (LMX). Researchers have identified a long list of characteristics that might have something to do with being effective in certain situations, but measures of these traits yield highly inconsistent relationships with being a good leader (Mann, 1959). In short, there is no universal list of enduring traits that all good innovation leaders must possess under all conditions (Isaksen and Tidd, 2006).

Studies in different contexts identify not only the technical expertise of leadership influencing group performance, but also broader cognitive ability, such as creative problem-solving and information-processing skills. For example, studies of groups facing novel, ill-defined problems confirm that both expertise and cognitive-processing skills are key components of creative leadership and are both associated with effective performance of creative groups (Connelly *et al,* 2000; Zaccaro *et al*, 2000). This combination of expertise and cognitive capacity is critical for the evaluation of others' ideas, and a key role of creative leadership in such environments is to provide feedback and evaluation. Also, it suggests that the conventional linear view that evaluation follows idea generation may be wrong. Evaluation by creative leadership may precede idea generation and conceptual combination.

In addition, it is easy to focus too much on the contributions of leadership, which is typically more visible and vocal, whereas other less evident key individuals are often as important in practice (Table 2). Leadership of innovation should not be confused with seniority of management. The research is clear that innovation is often led by individuals that do not necessarily climb or are suited to the organization hierarchy, and moreover do not share characteristics common to such leaders. Other additional important individual roles have been identified, including innovation champions (Bertels *et al*, 2020; Mansfeld *et al*, 2010), and gatekeepers (Allen, 1997).

The intent to innovate includes the motivation, goals and context of the organization and managers. Therefore, it anticipates but influences the definitions of the "value of innovation", an independent element in the standard. It also raises the choice of the most relevant type and degree of innovation to achieve these goals, for example, radical versus incremental changes, and an emphasis on product or process development. These are critical decisions as the management of innovation will be different in each case and will require distinct resources and capabilities (Tidd and Bodley, 2002; Tidd and Hull, 2006; Tidd and Hsieh, 2012).

Organization

The organizational factors that may encourage or constrain innovation include high-level structures, processes, culture and climate, teams and key individuals (Table 2). It is critical here to understand that there is no single "best" recipe for innovation, but rather that different combinations or configurations will better fit the nature of the project and organizational environment, the so-called contingency view (Tidd,2001).

Table 2. Organizational factors known to support innovation

Factor	**Key Features**
Shared vision, leadership, and the will to innovate	Clearly articulated and shared sense of purpose Stretching strategic intent "Top management commitment"
Appropriate structure	Organization design that enables creativity, learning, and inter-action. Not always a loose "skunk works" model; key issue is finding appropriate balance between "organic and mechanistic" options for particular contingencies
Key individuals	Promoters, champions, gatekeepers, and other roles that energize or facilitate innovation
Effective team working	Appropriate use of teams (at local, cross-functional, and inter-organizational level) to solve problems Requires investment in team selection and building
High-involvement innovation	Participation in organization-wide continuous improvement activity
Creative climate	Positive approach to creative ideas, supported by relevant motivation systems
External focus	Internal and external customer orientation Extensive networking

Source: Adapted from J Tidd and J Bessant (2021) *Managing Innovation: Integrating technological, market and organizational change*. New York: Wiley. Seventh edition. Reproduced with permission.

Planning and Support

Planning and innovation have a problematic relationship. At the project and product levels, planning and innovation generally have a positive relationship (Rothwell *et al*, 1974; Fosstenløkken, 2019; Lill *et al*, 2020). However, at the aggregate organizational level the relationship is less clear, which challenges the notion of an “innovation system” approach. There is a long-standing debate in the innovation field which contrasts the so-called “rational planning” school of strategy, with the more incremental, iterative “resource-based view” (RBV) of strategy. The balance of evidence appears to support the latter as a better explanation and guide to managing innovation (Teece *et al*, 1997; Keupp *et al*, 2012). Therefore, it is curious why the standard proposes a more planning-based approach. This debate has two sets of implications for managers. The first concerns the practice of corporate strategy, which should be seen as a form of organizational learning, rather than simply planning, from analysis and experience, how to cope more effectively with complexity and change. The implications for the processes of strategy formation are therefore (Tidd *et al*, 1997):

- Organization-specific knowledge – including the capacity to exploit it – is an essential feature of competitive success.
- An essential feature of corporate strategy should therefore be an innovation strategy, the purpose of which is deliberately to accumulate such specific knowledge.
- An innovation strategy must cope with an external environment that is complex and ever changing, with considerable uncertainties about present and future developments in technology, competitive threats, and market (and nonmarket) demands.
- Given uncertainty, explore the implications of a range of possible future trends.
- Ensure broad participation and informal channels of communication.
- Encourage the use of multiple sources of information, debate and scepticism.
- Expect to change strategies in the light of new (and often unexpected) evidence.

Process

This rational-planning approach extends to the innovation process advocated by the standard. According to the standard, following the identification of opportunities, the concept is created and validated, and the solution is developed and deployed. This description of the process is too linear, and fails to capture the complexities and contexts of managing innovation.

Our understanding of the core innovation process model has changed a great deal over time. Early models (both explicit and, more important, the implicit mental models whereby people managed the process) saw it as a linear sequence of functional activities. Either new opportunities arising out of research gave rise to applications and refinements, which eventually found their way to the marketplace (“technology push”) or else the market signals needs for something new, which then drew through new solutions to the problem (“need pull,” where necessity becomes the mother of invention). The limitations of such an approach are clear: in practice, innovation is a coupling and matching process where interaction is the critical element (Rothwell, 1994). Sometimes, the “push” will dominate, sometimes the “pull,” but successful innovation requires interaction between the two. Contextual factors will also require the process to be modified (Table 3).

Table 3 Contextual factors that influence the innovation process

Context Factor	Modifiers to the Basic Process
Sector	Different sectors have different priorities and characteristics – for example, scale-intensive, science-intensive
Size	Small firms differ in terms of access to resources, and so on and so need to develop more linkages

National systems of innovation	Different countries have more or less supportive contexts in terms of institutions, policies, and so on
Life cycle (of technology, industry, etc.)	Different stages in life cycle emphasize different aspects of innovation – for example, new technology industries versus mature established firms
Degree of novelty- continuous versus discontinuous innovation	"More of the same" improvement innovation requires different approaches to organization and management to more radical forms. At the limit, firms may deploy "dual structures" or even split or spin off in order to exploit opportunities
Role played by external agencies such as regulators	Some sectors – for example, utilities, telecommunications, and some public services – are heavily influenced by external regimes, which shape the rate and direction of innovative activity. Others – such as food or health care – may be highly regulated in certain directions

Source: Adapted from J Tidd and J Bessant (2021) *Managing Innovation: Integrating technological, market and organizational change*. New York: Wiley. Seventh edition. Reproduced with permission.

Therefore a balance needs to be struck between simplifications and representations that help thinking and action, but just as the map is not the same as the territory it represents, so they need to be seen as guidelines, not as prescriptions for the way the process should actually operate. In practice most innovation is messy, involving false starts, recycling between stages, dead ends, jumps out of sequence, and so on. So, any innovation process needs to be flexible, highly iterative and able to change direction or pivot when necessary (Ries, 2011). The innovation process does not necessarily begin with concepts that can be validated or problems seeking solutions (Van de Ven, 1999; Van de Ven *et al*, 1988). Therefore, any process to support innovation needs to be able to take into account the many complex ways in which the simple linear model is challenged by reality:

· Shocks trigger innovations – change happens when people or organizations reach a threshold of opportunity or dissatisfaction.

· Ideas proliferate – after starting out in a single direction, the process proliferates into multiple, divergent progressions.

· Setbacks frequently arise, plans are overoptimistic, commitments escalate, mistakes accumulate, and vicious cycles can develop.

· Restructuring of the innovating unit often occurs through external intervention, personnel changes, or other unexpected events.

· Success criteria shift over time, differ between groups, and make innovation a political process.

Performance evaluation and Improvement

There are two broad approaches to measuring innovation, which reflect the origins of the field we discussed earlier. The first, rooted in new product development, has a long tradition and seeks to identify success factors for specific focal innovations – products, services, projects or businesses (Rothwell *et al* 1974; Brem *et al*, 2019). The second approach, derived more from operations management, focuses on organizational-level innovation outcomes or their proxies such as patents, proportion of revenue from new products, value-added and so on, and then identifies factors that contribute to differential outcomes (Tidd *et al*, 1996; Tidd, 2012). The first approach tends to yield innovation attributes which are associated with success, the second approach reveals organizational processes and tools which are more or less effective at contributing to innovation outcomes (Tidd and Hull, 2006; Tidd and Thuriaux-Alemán, 2016). These two approaches are often combined to create innovation diagnostics, audits or benchmarking methodologies (Chiesa *et al*, 1996; Markham and Lee, 2013; Hull and Storey, 2016). However, it is important that such normative methods are based on empirical evidence from relevant settings, rather than simply being based on current popular prescriptions or management theories.

Value

The creation of value is one fundamental way to assess the success of innovation. However, it is too often reduced to financial measures or intellectual property. Business model innovation potentially offers to capture a broader range of benefits, but still tends to focus on commercial and financial imperatives (Casadesus-Masanell and Ricart, 2012; Gambardella and McGahan, 2010 Sanchez and Ricart, 2010; Zott *et al*., 2011). There is no single consensus definition of a business model, but Teece (2010) suggests at the core is the: “design or architecture of the value creation, delivery, and capture mechanisms” (p.127). Therefore, a business model should be able to link two dimensions of firm activity - value creation and value capture. Value creation and capture are linked by what is sometimes called value delivery (Casadesus-Masanell and Ricart, 2010). According to David Teece (2010), the 'business model' defines the way the company creates and delivers value to customers, and then captures a portion of this value to make profit and grow. Organizations which pursue this type of innovation develop novel value creation architectures and original revenue models, more than focus just on new products or new services. Business Model Innovation (BMI) involves the integration and adaptation of capabilities, and the exploitation of these novel combinations to create and capture value in new ways (Gambardella and McGahan, 2010).

Schneider and Spieth (2013) argue that BMI “is simultaneously about the (re) deployment and usage of existing resources and capabilities to develop new value offerings or forms of value creation… the question of ‘how’ to use resources has been less considered” (pp.4;15). Despite the increasing number of investigations in the field, much remains to say. First, most of studies on BMI are conceptual (e.g. Koen *et al*., 2011) or case-based (e.g. Casadesus-Masanell and Ricart, 2010; Desyllas and Sako, 2013), whilst quantitative investigations are limited. Second, and most important, these contributions have primarily addressed the capture and the monetization stage, rather than its value creation architecture (e.g. Baden-Fuller and Haefliger, 2013; Witell and Logren, 2013). The literature has focused too much on the downstream options, but studies of the upstream or 'back-end' of BMI are less common. Studies focusing on the relationships between capabilities, business model innovation and firm performance are needed.

So too much of the current BMI research adopts a narrow goal on how best to capture value, often downstream in the process, and typically in a business environment. Consequently, there have been a proliferation of typologies and case studies, but fewer significant insights into how innovation can create and capture value in different contexts. In contrast, innovation research and practice might benefit from a deeper focus on the capabilities and mechanisms which create value, in a broader range of commercial and social contexts.

What's missing?

Overall, there is no doubt that the ISO standard captures most of the essential building blocks for managing innovation. However, for each of the blocks extreme care must be taken not simply to reflect current popular approaches, often distilled from the experience of technology start-ups in the USA, but instead to draw upon the extensive research and practice from the existing and emerging body of knowledge (Tidd and Bessant, 2018; 2021). More fundamentally, the underlying logic of the standard system has several structural weaknesses which will be elaborated in this next section.

Innovation system is too linear

The central process within the standard, from planning to opportunity identification through validation to deployment, is inherently linear. In the same ISO group of standards as 56002 are additional standards for idea management, strategic intelligence, and intellectual property, the focus of which reveal the implicit assumption of a linear model of innovation, top-down, from idea to proprietary invention. However, the limitations of this linear model are well-established (Rothwell, 1994), as we discussed earlier in the sections on Planning and Process.

Also, the standard is too product-centric, and would benefit from the inclusion of a broader range of forms of innovation, such as incremental process or radical organizational, which do not fit this linear ideation-validate-solution model very well (Tidd and Bodley, 2002; Kompella, 2019). Other non-product/process innovations, what we have referred to as positional and paradigm innovation, consist of much more than the creation of novel artefacts, and include business model innovation (Tidd and Bessant, 2021). Moreover, the proposed system does not sufficiently deal with managing risk and uncertainty, which are inherent in many forms of innovation, especially technological and new ventures (Brillinger, 2018; Sadeh and Dvir, 2020).

Lack of innovation tools

Like earlier standards for quality management, the innovation standard is not prescriptive on how the goals are to be achieved. Whilst it is difficult to identify and codify best or even good innovation management practices, this lack of a specific toolkit to support managers and organizations is a major failing.

Tools act as useful heuristics to support decision-making and action, and can help to overcome cognitive and experiential biases (Eggers and Kaplan, 2008; Hales and Tidd, 2009; Levinthal, 2011). There is no shortage of such tools from the literature, so the challenge is to identify which work best and under what conditions (Tidd and Bodley, 2002; Tidd and Hsieh, 2012). For example, Dooley *et al*., (2002) identified 98 innovation good practices from prior research, and based on a survey of 39 firms found that practices associated with innovation strategy, including technological leadership and project selection, were more commonly adopted than those practices associated with the fuzzy front-end (such as concept generation) and controlling the execution of R&D and NPD (such as process control, documentation and metrics), but the small sample size (n=39), and broad diversity of sectors did not allow for the identification of industry variations. Phaal et al. (2006) developed a tool catalogue using a hierarchical topic-based structure, and grouped 850 tools into 11 functional clusters. Boly *et al*. (2014) proposed an innovation capacity measure based on a set of 15 firm-level innovation management practices, derived from practices in 39 small and medium-sized enterprises (SMEs). Schweitzer and Tidd (2018) identify which tools are effective for engaging users and customers in the innovation process.

Therefore, innovation tools are important for two reasons. First, they codify and operationalize research findings and good practices, so promote dissemination and adoption. Second, we know that the use of tools is significantly associated with superior innovation outcomes, but importantly, different tools work best in different industry and innovation contexts (Tidd and Thuriaux-Alemán, 2016). This makes it difficult to provide a standard toolkit for universal use, but instead the goal should be to map useful tools against specific management challenges and organizational contexts.[1]

Insufficient sectoral diversity

A standard is by nature a high-level, generic framework, but as a result it can fail to capture the different contexts of organizations and challenges of managers, such as the industry sector, firm capabilities, and size of organization, all factors that we know influence how innovation can be best managed (Tidd, 2001; Tidd and Hull, 2006). For example, sectors differ greatly in whether their innovation focus is on products or processes, and this focus can change over the product life-cycle (Utterback and Abernathy, 1975). They also differ in where they get their innovations from (suppliers, customers, academic science), where innovation takes place in the firm (R&D labs, production engineering and design departments), and what their customers require (price, performance or both). This diversity cautions against generalizing from the experiences of one firm or sector, or from unthinkingly applying population level findings to individual firms. To take this diversity into account Pavitt (1984) developed his famous taxonomy, which provides a useful guide to the strategic management of innovation. While the taxonomy has held up well to subsequent empirical testing, it has become increasingly clear that there are generic patterns of innovation that cut across all the categories in the taxonomy. For example, the application of information technology and scale-intensive process technology, especially in sectors where the distinction between products and services is declining.

Given this diversity, there is a need for a generic framework for managing innovation, which integrates process, product and service innovation, but critically, one that also takes into account both diversity of organizational context and specific management challenges (Tidd and Bessant, 2021).

Conclusions

The motivations for adopting a management standard is not necessarily primarily to improve the efficiency or effectiveness of practice and performance, but is often driven by the need for institutional legitimacy and professional conformity (Benders and Slomp, 2009; Daniel *et al*., 2012). Nevertheless, care should be taken that any management standard promotes, rather than constrains, innovation in practice, and to do so must therefore enable organizations to innovate, rather than simply certify compliance.

The international standard for innovation management systems incorporates many of the elements known to influence innovation. However, unlike similar prior standards for project management and quality management, the field of innovation management is less well-defined and arguably inherently more diverse and uncertain. By examining each of the major elements of the innovation standard, and the overall system logic, we have reviewed some of the relevant knowledge base, revealing some significant shortcomings. Whilst a management standard must promote high-level

[1] We have compiled a large number of innovation tools from research and practice, and grouped these by task, see: http://www.innovation-portal.info/toolkits/welcome/

generalities, the deeper body of knowledge, developed from decades of research and practice, demonstrate that how innovation should be best managed depends on the context and contingencies, such as the industry, project type, and size of organization, all of which will significantly moderate any standard process or system. Moreover, the systems approach is too abstract and high-level for most organizations and managers to apply, so specific innovation management tools are needed to enable organizations, teams and individuals to better manage innovation.

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